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JOINT RESEARCH VENTURES
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New product

Flame-spray coating technology developed

A highly successful joint research venture between the Alberta Research Council and Canadian Flamecoat Systems Inc. has resulted in a sophisticated flame-spray coating technology the Calgary company will be marketing internationally.

The flame-spray technology spreads a plastic coating on surfaces which protects them from environmental damage such as corrosion, abrasion and adverse weather. It has applications in a number of areas including the chemical, petrochemical, pulp and paper, and the food and agriculture industries. In the flame-spray coating method, plastic powder is drawn from a feed container and propelled through a flame in the applicator. When the molten powder particles strike the surface, they spread in a film and harden to form a solid coating when cooled.

Canadian Flamecoat first identified the flame-spray technology in the United States in 1987.

"We spent a year and a half trying to market it in Canada but there were too many problems with the equipment," says Randy Gosselin, Canadian Flamecoat president. "We did two preliminary projects through IRAP (Industrial Research Assistance Program) and then began the JRV (joint research venture) with the Research Council in 1989."

The JRV involved two Research Council departments: Oil Sands and Hydrocarbon Recovery (OSHR) and Manufacturing Technologies. OSHR's Dr. S.V. Rajan, project manager, along with Mario De Rocco, worked on the system design. Denise Lamy and Ron Rau, Manufacturing Technologies, carried out the materials research.

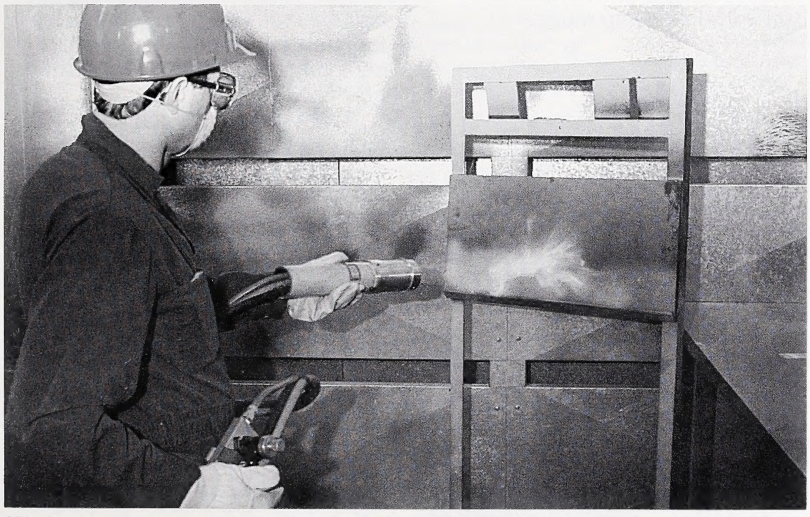
Mr. Gosselin says, "We have state-of-the art equipment because of this joint research. The Research Council team addressed every weakness with the equipment. We've had a number of inquiries from other countries about setting up distributorships and are following them up."

The $830,000 project wrapped up in July. It met both its objectives: design a new high-capacity flame-spray system and assess the performance of new polymer coatings.

Material testing involved assessing nine thermoplastic coating materials. The final report is a catalogue of the physical properties of the materials, and the mechanical and chemical resistance of the coatings. The catalogue will enable users to select the best thermoplastic powders for specific applications.

On the equipment side, the research team worked on overcoming the limitations of the original flame-

Flame-spray *continued on page six*



Worker demonstrates flame-spray coating.

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ALBERTA RESEARCH COUNCIL

Value-added pump valve

Company hopes to crack $60 million market

With the help of the Alberta Research Council, a small Edmonton company is planning to crack the $60 million market for oil well pump valves. Rod Pump Specialty Valve Limited and the Research Council have entered into a joint research venture worth $707,500. Their aim is to develop and test new wear and corrosion resistant materials for Rod Pump's main product lines, Petrovalve Plus and Petrovalve Gas Breakers.

Petrovalve Plus is a new patented valve for use in the pumps that lift crude oil to the surface of oil wells. Equipped with a plunger and guide mechanism to ensure seating surfaces are protected from internal damage while in use, Petrovalve's design is markedly different from the traditional valve. Petrovalves will improve the bottom line for producers in several areas, providing greater efficiency, slower pumping speeds and longer life.

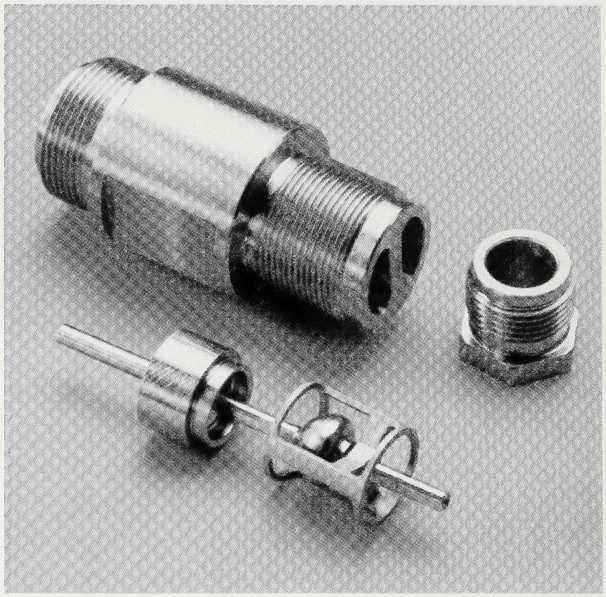
For example, if well conditions have high sand levels, a problem in many Alberta wells, Rod Pump would like to offer the highest quality wear resistant valves possible. For less severe environments, materials such as stainless steels and stalites will be used.

"This is where the Alberta Research Council comes in," says Doug Jensen, of Rod Pump. "We're a small company and have brought the product line as far as we can. Now we need the Research Council's expertise to develop our top of the line model."

The joint research venture involves the Research Council's Manufacturing Technologies and Oil Sands and Hydrocarbon Recovery (OSHR) departments. OSHR has the specialized equipment – a multiphase flow loop – needed for testing the valves. Manufacturing Technologies is responsible for testing and evaluation of materials.

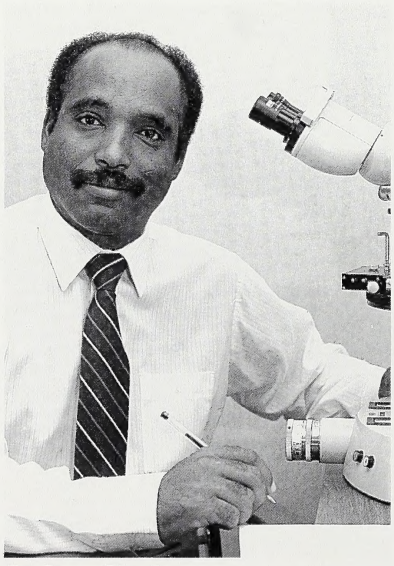
The joint research venture project is expected to take two years. Project leader Dr. Dave Ghosh, Manufacturing Technologies department, says, "from our lab work, we'll know fairly soon which materials to concentrate on. The end product may not be made from only one material, but may be specially reinforced at the surfaces most prone to wear."

The research team will look at metal alloys, "cermets" (metal and ceramic composites), and ceramics. Coating technologies such as plasma activated deposition, done at the Research Council, and reactive laser deposition, done at the Alberta Laser Institute, will be evaluated for possible use.



Petrovalve® Plus valves

Petrovalve Plus is the brainchild of inventors Doug Jensen and Ken McConnell. Together they have some 41 years experience in the oil patch – Jensen in lift systems, McConnell in pump repair.



Dr. Dave Ghosh

"We knew the conventional valve was the weak link in the lift system, so we decided to design our own valve, one that would allow substantially higher productivity and performance," explains Mr. Jensen. "We did research and prototype testing for a few years, then formed the company in late 1989 to market the new design.

"At first our motivation was simply to prove to ourselves that we could do this, but when our valve did well at test sites and people in the industry became enthusiastic, the project took on its own life."

Rather than carry only one standard Petrovalve Plus model, Rod Pump wants to market a complete line of valves each tailored to specific downhole conditions. Such an innovation would put the company in a good position to capture much of the ball and seat valve market in North and South America, estimated to be worth $60 million a year.

Contact: Dr. Dave Ghosh, Alberta Research Council 403/450-5290; or Doug Jensen, Rod Pump Specialty Valve Ltd., 403/450-6534. □

Grow Tec

Biotechnology collaboration under way

Years of research experience on bacteria called Rhizobium have allowed the Alberta Research Council's Biotechnology department to develop a number of commercial contacts. Now, the department has entered into a Joint Research Venture (JRV) with one of those contacts – Nisku-based Grow Tec Ltd. The JRV involves development and scale-up work on genetically engineered strains of Rhizobium.

Rhizobium-nutrient coats are one of the product lines offered by Grow Tec, a custom seed coating company. When the seeds of legumes such as alfalfa, clover and peas are inoculated with Rhizobium bacteria, they can convert nitrogen from the air into nitrogen that is usable by the plant. The introduction of legumes into a crop rotation allows farmers to cut down on the use of synthetic nitrogen fertilizers.

"With the move to sustainable agriculture, these seed coatings are becoming more popular," says Grow Tec's president Tony Cabral. "Grow Tec has long been a champion of Rhizobium coats and has influenced the industry to pay more attention to them. As a result, we needed to improve the coatings we offer.

"The Alberta Research Council has probably the best capability in the country for this kind of work."

The objective of the JRV is to develop highly effective Rhizobium inoculants designed specifically for alfalfa. Researchers from Grow Tec are collaborating with scientists at the National Research Council's Plant Research Centre (PRC) in Ottawa. The PRC has successfully isolated several strains of Rhizobium meliloti which show good promise as alfalfa inoculants. Grow Tec has acquired exclusive rights for commercial development of these strains.

The Alberta Research Council's biotechnology department will compare the strains to select the most stable ones and do the scale-up and quality control work necessary for large-scale production of Rhizobium inoculant. The JRV also involves laboratory and field evaluations of inoculants and protective coatings, and further development work on protective seed coatings.

The entire project, including final field evaluation and market study, is expected to take three years.
Contact: Dr. Brad Thompson, Alberta Research Council, 403/450-5305; or Tony Cabral, Grow Tec, 403/955-2774. □

Healthy alfalfa

New product is aim

Lethbridge company seeks technical help

A move into a new product can be a risky venture even for an established company. Lethbridge-based Flexahopper Plastics Ltd. has been manufacturing plastic containers for 24 years and is the largest rotational molder in Alberta. When the company saw an opportunity to manufacture reusable plastic containers for the transport of liquid dangerous goods, it turned to the Alberta Research Council for technical assistance.

"Flexahopper came to the Research Council with the challenge of developing a new product using advanced engineering design methods," says Bill Spenceley, plastics engineer with Flexahopper. "We knew that extensive design analysis would be essential and that the Research Council has the capability to handle the job."

A small-valued joint research venture is now under way. The research team includes staff from Flexahopper, the Research Council's engineering services group in Calgary, and other Manufacturing Technologies department researchers in Edmonton. They are working on the container development with emphasis on design for manufacture. The work involves a literary search of standards, patents and journals (including a review of failure reports), container design using computer-assisted finite element analysis, prototype testing, liaison with a consultant on an in-plant quality control program for the product, and coordination in the development of automation of the container manufacturing process.

"The engineering of the container must be of high quality and must meet or exceed Canadian and international standards," says Jeff Watson, Manufacturing Technologies, project leader for the JRV.

"Consequently we're putting a considerable amount of effort into the design side. Finite element analysis allows us to evaluate the designs without having to produce and test numerous prototypes. This reduces the design cycle time and the development cost. The JRV is an opportunity for Manufacturing Technologies to further develop this expertise which will allow us to assist more companies."

For Flexahopper, the key benefit of the JRV will be the product itself. "The JRV provides Flexahopper with an opportunity to develop an excellent container using state-of-the-art engineering and design practices," says Flexahopper's Spenceley. "We hope to market the product both domestically and internationally."
Contact: Jeff Watson, Engineering Services Group, Calgary 403/297-7565; or Bill Spenceley, Flexahopper Plastics 403/328-8146. □

Joint Research Venture Projects

LARGE JRVs

Company: Western Geophysical Company of Canada Ltd., Calgary
Project: To develop precision seismic processing and interpretation techniques to monitor conventional reservoir flooding.
Start: February, 1987 **Finish:** June, 1990
Commercialization: A Rock Catalogue, generated through the JRV, is being marketed and sold to major oil and gas companies worldwide.

Company: Pelorus Aviation Supplies (Canada Ltd.), Calgary
Project: To develop an airborne microwave landing system (MLS) for small to medium aircraft.
Start: February, 1987 **Finish:** January, 1991
Commercialization: Project was terminated based on a decision by Pelorus not to continue with the software module development part of JRV, and to pursue DME/P equipment related to RF circuitry.

Company: Standen's Ltd., Calgary
Project: Improve the manufacture of tapered springs used in vehicles; design a flexible work cell, selection and installation of a robotic cell.
Start: October, 1987 **Finish:** December, 1988
Commercialization: The robotic workcell is being used in the production of tapered leaf springs. The project has shown that robots in unclean factory settings are practical.

Company: Canadian Foremost Ltd. (HEP Division), Calgary
Project: To produce a digital controller for heavy oil pumps using adaptive control techniques.
Start: April, 1988 **Finish:** May, 1989
Commercialization: A prototype system was designed, built, and tested on HEP pumps.

Company: Pulsearch Consolidated Technology Ltd., Calgary
Project: Development of an inertial pig to inspect pipelines for deformities.
Start: May, 1988 **Finish:** February, 1990
Commercialization: Pigco Pipeline Services Ltd. was formed to market the pipeline inspection services worldwide, now owned and operated by Nowsco Well Services Ltd.

Company: DataSpan Technology Inc., Calgary
Project: Software development for automatic recognition of characters including handwritten characters from digitized maps.
Start: August 1988 **Finish:** September, 1990
Commercialization: Service is offered as part of DataSpan's production center and licensed to computer vendors. Technology is being marketed worldwide; sales have been completed to date in France, Germany, Japan, Taiwan and U.S.

Company: Applied Terravision Systems Ltd., Calgary
Project: Development of a 3-D Stereo Imaging capability with SPOT Image satellite data.
Start: February, 1989 **Finish:** May, 1990
Commercialization: Marketed as part of a larger "Landscan" service currently being offered by the ATS data centre. The product is also licensed to computer vendors.

Company: Superfine Sulphur Ltd., De Winton
Project: To develop a chemical process for producing finely divided sulphur.
Start: March, 1989 **Finish:** July, 1990
Commercialization: A pilot production plant is in operation in De Winton, Alberta. Product is being test marketed to agriculture and pesticide industries.

Company: Gienow Building Products Limited, Calgary
Project: Automation of a window manufacturing facility for increased production capability and export potential.
Start: March, 1989 **Finish:** December, 1991
Commercialization: Plant automation has increased production capability and enabled company to tap international markets. As a result, Gienow has undertaken a 30,000 sq. ft. plant expansion, has secured a major Japanese contract, and has expanded its staff from 120 to 180 employees in the past year.

Company: Maloney Steel Limited, Calgary
Project: Advanced oil/water separation techniques.
Start: June, 1989 **Finish:** December, 1992
Commercialization: Will be sold to major producers.

Company: Microtech Well Logging and Wellsite Consulting Ltd., Calgary
Project: Development of an artificially intelligent wellsite measurement and evaluation system.
Start: June 1989 **Finish:** October 1990
Commercialization: First commercial contract for the system was secured in 1991.

Company: Canadian Flamecoat Systems, Inc., Calgary
Project: To design new high capacity systems for thermoplastic spray coating technology; R&D on existing polymer and new chemically engineered polymers.
Start: November 1989 **Finish:** July 1991
Commercialization: Technology is being marketed internationally. This product will provide an economically efficient method of preventing deterioration of structures and equipment due to corrosion. Patent pending on design improvements to the flamespray equipment optimized within JRV.

Company: Alberta Environmental Systems Inc., De Winton
Project: To develop a process to recycle polyethylene terephthalate (PET) by depolymerization to dimethyl terephthalate (DMT) and ethyl glycol (EG).
Start: June, 1990 **Finish:** April, 1991
Commercialization: Project was terminated in April, 1991 due to technical problems identified with the process as well as poor economics due to current market conditions.

Company: Elsro Asphalt Ltd., St. Albert
Project: To optimize the production of asphalt industrial floor planking, and other construction products that incorporate post-consumer plastics, rubbers and fibres.
Start: July 1990 **Finish:** July, 1992
Commercialization: Elsro plans to expand its market potential internationally with new products. Forecasted increase in sales revenue is estimated at approximately $2.0 million annually.

Company: Superfine Sulphur Ltd., De Winton
Project: Following the successful completion of an earlier project, the company is now working on a project to optimize the process for the development of products from superfine sulphur suspensions.
Start: November, 1990 **Finish:** October, 1992
Commercialization: Production plant will be in full production for supply to the Fall fertilizer and pesticide markets.

Company: Amptech Corporation, Calgary
Project: To apply thixomolding technology to produce magnesium alloy and metal matrix composite parts.
Start: February, 1991 **Finish:** January, 1993
Commercialization: A major portion of the market for this technology will be international, leading to an export market for Alberta.

Company: Rod Pump Specialty Valve Ltd., Edmonton
Project: Testing and development of materials that are wear and corrosion resistant for valves for oil-well pumps.
Start: April, 1991 **Finish:** March, 1993
Commercialization: Product will displace the existing ball and seat valves in downhole well applications. Market potential exists for approximately 220,000 wells to be serviced annually, equal to over $5.5M in annual sales with 10% of the market share.

SMALL JRVs

Company: Trysol Inc., Calgary
Project: To develop a fire retardant additive for hydrocarbon based well servicing fluids.
Start: November 1990 **Finish:** August, 1991
Commercialization: Fire retardant has been identified. A distillation tower will be completed mid-September 1991. Initial customer response for specialized hydrocarbon based fire retarded fracturing fluids is positive with future ARC contract being negotiated.

Company: Weldwood of Canada, Slave Lake
Project: Self-induced steam pressing of oriented strandboard (OSB).
Start: November, 1990 **Finish:** March, 1991
Commercialization: Process was successfully demonstrated at a mill trial at Slave Lake. Following the JRV, the Weldwood plant at Slave Lake was shut down. The Slave Lake plant is for sale and Weldwood is considering offering technology as part of that sale.

Company: FRE Pultrusions Ltd., Edmonton
Project: The development of an apparatus for the dynamic evaluation of reinforced plastic sucker rods in a chemically and thermally aggressive environment.
Start: January, 1991 **Finish:** December, 1991
Commercialization: Company intends to make a significant expansion in the sucker rod market by providing an economic alternative to steel sucker rods. The anticipated market penetration is greater than $5M annually.

Company: GEOTECHnical resources ltd./Agat Laboratories, Calgary
Project: To develop and field test a portable well-site gamma ray logger for core logging.
Start: January, 1991 **Finish:** June, 1991
Commercialization: A joint paper on the project will be presented at a technical conference in September, 1991. Application of proven technology has worldwide potential. Major operators are supportive of the concept and have expressed interest in participating in field tests.

Company: Industrial Ceramic Systems, Inc., Calgary
Project: To develop industrial wear ceramics for wear and corrosion resistant applications in primary and secondary industries.
Start: January, 1991 **Finish:** November, 1991
Commercialization: ICS has a fully operational facility in Calgary producing slip cast ceramic lining systems designed to address hostile environments characterized by extreme abrasion, corrosion, high temperature and thermal shock. Target markets include mining, oil and gas, agriculture, power generation, pulp and paper, and petrochemical.

Company: Northstar Drillstem Testers Ltd., Calgary
Project: The development of a drillstem testing device.
Start: January, 1991 **Finish:** December, 1991
Commercialization: Company envisions an improved product for their own use in drillstem testing in Alberta and Canada. The Chinese market is rapidly developing and sales to countries other than China will also be developed.

Company: Benchmark Technologies Ltd., Calgary
Project: To extend the market for the company's Integrated Productivity WorkFrame (ISPW) product to include the IBM and other UNIX operating systems and to position the ISPW product to run concurrently on both a host and a PC, passing data and control in a peer-to-peer relationship transparent to the user.
Start: February, 1991 **Finish:** April, 1991
Commercialization: Due to technical difficulties with the hardware and software selected for the project, a cooperative processing environment was not actually demonstrated during the course of the 3 month project. However, Benchmark is confident that the project proved that a cooperative processing environment is feasible and commercially viable and intends to continue R&D in this area for future versions of ISPW.

Company: Penetrators Canada Inc., Red Deer
Project: To optimize the reliability and penetrability of a jet-rock penetration device for oil and gas wells.
Start: March, 1991 **Finish:** November, 1991
Commercialization: The market for this technology is aimed to service newly drilled wells as well as existing producers and injectors. Company anticipates exporting the technology to many of the world's oil producing countries.

Company: SMED Manufacturing Ltd., Calgary
Project: The development of a dynamic order entry and allocation system for SMED's operations in custom wood furniture manufacturing.
Start: April, 1991 **Finish:** January, 1992
Commercialization: Creation of state-of-the-art software could be transferred to other custom manufacturers. Upon implementation of the system, SMED expects to reduce its overhead costs currently attributed to order information errors and the amount of work required to produce custom furniture.

Company: Standen's Ltd., Calgary
Project: To develop an Artificial Intelligence (AI) software program to be called SMARTMAINT. This will assist the company's maintenance staff in predicting and diagnosing equipment failure.
Start: April, 1991 **Finish:** December, 1991
Commercialization: A well-established, yet unserviced market for software such as SMARTMAINT exists. Standen's intends to establish a separate company to market and distribute this software.

Company: DataSpan Technology Inc., Calgary
Project: This follows an earlier successful project with the company. The current project is the investigation and development of an intelligent raster to vector conversion using high level context for paper documents.
Start: April, 1991 **Finish:** December, 1991
Commercialization: Upon completion, project will be used by company's conversion department to increase the production. They will market the software internationally.

Company: Clearstone Engineering Ltd., Calgary
Project: Non-intrusive instrumentation for coal-fired boilers.
Start: June, 1991 **Finish:** August, 1992
Commercialization: Company intends to assemble the product in Alberta. They will install and service the metering systems from Alberta and market them to utility companies worldwide.

Company: Reber, Landry Oil Tool Company Ltd., Calgary
Project: The laboratory and field testing of a novel gas lift pump for oil production in partially depleted reservoirs.
Start: July, 1991 **Finish:** April, 1992
Commercialization: Company has obtained a patent pending status on their new design and intend to manufacture and sell their new product from Alberta. The principals of the company have extensive sales experience in gas lift tools.

Company: Flexahopper Plastics Ltd., Lethbridge
Project: Design of hazardous material transport containers.
Start: July, 1991 **Finish:** July, 1992
Commercialization: The environmental driven market for hazardous material containers is growing rapidly. With the location of a hazardous waste materials handling facility in Alberta, a ready market is available. Current Canadian market estimate is for 5,500 units with excellent export potential.

Company: Positive Action Tool Western Ltd., Calgary
Project: To design a progressive cavity pump rod centralizer system.
Start: July, 1991 **Finish:** February, 1992
Commercialization: The company is currently a world leader in the manufacture and sale of paraffin scraper/centralizers for reciprocating pumping systems. Estimated market is 300,000 - 400,000 units with excellent export potential. The product will be manufactured at their Edmonton manufacturing facility.

Company: Norac Group Inc., Edmonton
Project: The production of natural beta carotene.
Start: September, 1991 **Finish:** March, 1992
Commercialization: Major international marketing players have recognized Norac products as offering both technological and marketing advantages over traditional solvent extracted and steam distilled products. As a result of such contracts, Norac has entered marketing agreements and signed purchase orders 16 months prior to production.

Company: Grow Tec Ltd., Nisku
Project: Production of highly effective strains of Rhizobium Meliloti for Alfalfa Inoculants.
Start: August, 1991 **Finish:** July, 1992
Commercialization: Company marketing strategy is to attract large wholesale and retail clients to ensure an efficient distribution network for their seed coating technologies.

Company: Computer Modelling Group, Calgary
Project: Development of a unique Reservoir Visualization System.
Start: November, 1991 **Finish:** August, 1992
Commercialization: There are approx. 248 oil companies worldwide which can justify acquiring this technology through membership, 77 of these companies are presently members. An estimated 25-50 new memberships could be generated as a result of this project leading to $10-$20 million in incremental revenue.

Small JRV

Program aimed at helping small companies

Each year, a number of Alberta companies have innovative new products or processes they would like to take into the marketplace. But development requires technical expertise and financing that small or medium-size companies just don't have.

That's where a joint research venture (JRV) with the Alberta Research Council can bridge that gap. The JRV program has been operating for some eight years, and more recently, has been augmented by the small joint research venture (S-JRV) program for projects with a per year cost of $20,000 to $100,000. (List of current projects on page 4 and 5.)

A six-member committee meets once a month, providing a maximum turnaround of one month on small-JRV applications. Their decisions are guided by a number of criteria including:

- the result must be a new or enhanced service, process or product;
- it must be close to commercialization;
- it must benefit Alberta – for example more business, increased employment, enhanced quality of employment, increased national or international sales;
- it must be of strategic importance to the Alberta Research Council; and
- the contributions of the company and the Research Council must be equal and skills must be complementary.

"We have been pleased with the projects, the enthusiasm and drive of the applicants," says Dr. Boon, past-chairman of the Research Council's small-JRV review committee. "We've only declined one application. It was a straightforward application of existing technology; we're looking for things that are new."

The only external member on the small-JRV review committee – Touraj Nasseri, president of the Centre for Frontier Engineering Research – echoes Dr. Boon's statement.

"The applications I've reviewed have been well-prepared and innovative," says Dr. Nasseri. "Industry has made a genuine effort to find complementary expertise in the Alberta Research Council. The companies are not taking a shot to see what they can get. They're serious and professional about these applications."

Dr. Nasseri sees the JRV program as an "efficient way to use scarce R&D resources. It ties technological endeavors to the economic prosperity of Alberta. I believe the principal engine for economic growth is the linkages among science, technology and economic performance rather than activities in each separate area. Innovation is a means of survival and wellbeing in a competitive world, not just for Alberta, but for Canada.

"The JRV program responds to the need for the economy to be competitive and does so on a microeconomic scale. It allows individual companies to focus on their own survival by helping them link technology to markets. If we can take care of our problems on the single company scale, the province as a whole will benefit substantially. There's much potential here to greatly increase the return on investment in research."

Contact:
Karen Beliveau, Edmonton, 403/450-5211;
Lem MacDonald, Calgary, 403/297-2354. □

Flame-spray *continued from page one*

spray system. The problems included small capacity, lack of control over the operation, powder spillage from the container, and difficulties in refilling during operation.

"We have completely redesigned the flame-spray coating system," explains Dr. Rajan. "Now the operator can control the powder and the flame with a flick of a switch. Another innovation was putting the powder container in a remote location and attaching it to the spray applicator by a feed hose. Previously, operators carried the powder on their backs. This was not only unwieldy, but it also kept the powder warm which often resulted in plugged lines. We also simplified the design of the flame-spray applicator so that it is easy to manufacture and easy to clean."

The JRV team actually delivered two new flame-spray coating systems. One is a single flame-spray application system (U.S. patent pending); the other is a large-capacity pressurized system for the simultaneous operation of three flame-spray applicators. Field tested units for both systems were constructed.

"The success of this JRV is a demonstration of the experienced project management the Research Council offers industry," says OSHR department head Dr. M.P. du Plessis. "Our staff can take a concept and carry it through all stages, from design to commercial application. We have drawn on our expertise in multiphase (gas-solid) flow to make the project a technical success."

Flamecoat is now displaying the new equipment to clients. With further product improvements Mr. Gosselin sees potential for the incorporation of automation and robotics into the system.

Contact: Dr. S.V. Rajan, Alberta Research Council 403/472-4286; or Randy Gosselin, Canadian Flamecoat, 403/269-8530. □

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